

may pass through the sensitised paper, the resistance R must be high; the EMF of the battery B must therefore be great, and several cells should be used.

An electromotive force is produced by the action of the platinum point, and the metal cylinder upon the sensitised paper, and the resulting current is for many reasons very annoying. I have got rid of this by coating the surface of the cylinder with platinum foil.

Stains are apt to appear upon the under-surface of the paper, which sometimes penetrate through and spoil the picture. They may be prevented by washing the surface of the cylinder occasionally with a solution of ammonia.

Slow rotation is essential in order both that the decomposition may be properly effected and that the selenium may have time to change its resistance. The photophone shows that *some* alteration takes place almost instantaneously with a variation of the light, but for the greater part of the change a very appreciable period of time is required.

The distance between the two instruments might be a hundred miles or more, one of the wires, M , N , being replaced by the earth, and for practical use the two cylinders would be driven by clockwork, synchronised by an electromagnetic arrangement. For experimental purposes it is sufficient to connect the two spindles by a kind of Hooke's joint (some part of which must be an insulator), and drive one of them with a winch-handle.

The instrument might be greatly improved by the use of two, four, or six similar selenium cells and a corresponding number of points. If two such cells were used the transmitting cylinder would have two holes, diametrically opposite to each other, with a selenium cell behind each. A second point would press upon the under surface of the receiving cylinder, and be so adjusted that the lines traced by it would come midway between those traced by the upper point. Four or six selenium cells could be similarly used. The adjacent lines of the picture might thus be made absolutely to touch each other, and moreover the screw upon the spindles might be coarser, which for obvious reasons would be advantageous. A self-acting switch or commutator in each instrument would render additional line-wires unnecessary.

SHELFORD BIDWELL

NOTES

THE Murchison medal of the Geological Society has this year been awarded to Prof. Geikie.

THE Associateship of the Institute of Chemistry, along with the prize of 50*l.*, offered by Prof. Frankland for the "best research involving gas analysis," has been awarded to Mr. Frank Hatton, of 14, Titchfield Terrace, Regent's Park, student in the Royal School of Mines, South Kensington.

WE regret to record the death, at the age of seventy-seven years, of Mr. John Gould, F.R.S., the eminent ornithologist. We hope to give some account of his life and work in our next number.

A REMARKABLE discovery has been made by Mr. Alex. Adams, one of the technical officers of the Post Office Telegraph Department. It is the existence of electric tides in telegraph circuits. By long-continued and careful observations he has determined distinct variations of strength in those earth currents, which are invariably present on all telegraphic wires, following the different diurnal positions of the moon with respect to the earth. He will read a paper on the subject at the meeting of the Society of Telegraph Engineers to-night.

MR. JOSEPH THOMSON has, we understand, received the offer of an advantageous post under the Sultan of Zanzibar, which no doubt he is likely to accept. Mr. Thomson's work will be mainly that of geological surveying in the region of the Rovuma River, and the Sultan has offered him every facility for carrying

on the work. The Sultan deserves every credit for showing such enterprise, and we have no doubt that Mr. Thomson will be able to do work of great scientific value.

AT the Royal College of Surgeons Prof. W. K. Parker, F.R.S., will give nine lectures on the Structure of the Skeleton in the Sauropsida, on Mondays, Wednesdays, and Fridays, February 11, 16, 18, 21, and 23, at 4 p.m. Prof. W. H. Flower, LL.D., F.R.S., will give nine lectures on the Anatomy, Physiology, and Zoology of the Cetacea, on Mondays, Wednesdays, and Fridays, February 28, March 2, 4, 7, 9, 11, 14, 16, and 18, at the same hour.

WE are glad to learn that the new 23-inch object-glass of Prof. C. A. Young of Princeton, N.J., is completed. Prof. Young has tested it at Cambridge, Mass., and finds it very fine; he hopes by and by to do some good stellar spectroscopic work with it. The mounting is well under way, and it is expected that the instrument will be in place next autumn.

MR. LAMONT YOUNG, the Government geologist of New South Wales, has suddenly and mysteriously disappeared, and foul play is suspected. Mr. Young arrived safely at Bermagui, 180 miles south of Sydney, and at once set out to cross the bay in a boat. No news of him came in, and two days later his boat was found jammed among the rocks of the coast, ten miles north of the point from which he had started. It was at first, and naturally, supposed that Mr. Young and his company had been drowned, and that his boat had drifted on shore. A closer examination proved that the boat had been drawn carefully up on the coast, and that the party had dined after landing. Next some bullet holes were found in the boat, and this suggested the idea that the explorers had been attacked and murdered. But not a single mark of blood or additional trace of any violent assault could be discovered. The party were five in number, and the coast has been examined for traces or tidings of them in vain. An official of the Mines Department has been assisted by detectives and by the boasted "black trackers," natives whose acuteness is seldom at fault in a case of this sort.

PROF. MCK. HUGHES writes on January 27, suggesting the following scientific uses of the late severe weather:—When this frost breaks up and the frozen snow and ice begin to travel along our rivers to the sea there will be an opportunity of making observations upon several points upon which accurate information will be of use in seeking an explanation of some of the glacial and post-glacial phenomena of the British Isles, *e.g.* (1) Dimensions of the ice floes; (2) whether they consist chiefly of frozen snow or solid ice, *i.e.* an approximate estimate of their specific gravity; (3) amount of material carried by them and dimensions of larger boulders; (4) whether any of these were dropped on to the floe from cliffs of glacial drift so as to give scratched stones and *remanie* drift in modern mud; (5) how far out to sea such floes have been traced with or without earth and stones; (6) salinity of the water where the observations were made; (7) transport of shore shells, &c., by ice; (8) crumpling of mud by impinging ice; (9) grinding of ice along bridge piers, and many similar observations which it will be useful to record.

THE great annual *soirée* at the Observatory of Paris has been a great success. Almost all the Cabinet ministers and M. Gambetta were present. A plan was exhibited in the Astronomical Museum showing the present state of the Observatory, and what it will be when all the works for which credits have been voted shall be completed. A ball took place after a series of lectures and projections given in the *grande galerie*. One of the lecturers, M. Bertus, exhibited magic mirrors, and reminded those present that in 1844 M. Mouchez, then a junior officer in the French naval service, brought home with him one of these mirrors from Japan, which was presented to the Academy

of Sciences by Arago. The *Comptes rendus* states that Arago was asked to inquire into the properties of this curious phenomenon, but it does not appear that he made any effort to comply with the request of the Academy.

AFTER a series of experiments which have proved successful, the Administration of French lighthouses has given an order to M. de Meritens to build six magneto-electric machines for the three first lighthouses which are to be illuminated by electricity.

THE Chemical Section of the Russian Physico-Chemical Society has, on the proposal and at the expense of Mr. V. J. Ragosine, established a competition for a prize of 750 metallic roubles (3000 francs) for the invention of a lamp intended to burn the heavy oils of petroleum (naphtha), *i.e.* the parts of the raw petroleum which distil after the kerosene or ordinary petroleum (density from 0.79 to 0.83 at 20° C.); as also astral oil (density 0.83 to 0.85 at 20° C.), but before the oils intended for greasing purposes (density about 0.88), *i.e.* oils whose density is from 0.85 to 0.88 at 20° C. The lamps ought (1) to be as simple as possible in construction, so that they may be easily manufactured and manipulated; (2) only glasses existing already in the retail trade to be used, if they are used at all; (3) to burn, without giving either soot or smell, the heavy oils whose density is at least between 0.865 and 0.875. The lamps must be sent in by January 12, 1882, and three specimens of each should be sent, accompanied by a detailed description in Russian, French, German, or English. There is no restriction as to nationality. Further information may be obtained from the Secretary of the Society, St. Petersburg.

WE would call the attention of our readers to a very valuable and ingenious instrument which has been recently introduced by Messrs. Francis and Co., the Telegraph Engineers, Hatton Garden, London, for the purpose of receiving the "Greenwich Time Signal" at the various telegraph stations and offices of private firms who may be in communication with the Postal Telegraph Service. Hitherto the passage of the time-signal current at 10 a.m. along the wires gives no other indication of its presence than a deflection of the needle of ordinary instruments, and a corresponding movement of the armature of the Morse Ink-Writer and Sounder, so that unless a sharp look-out be kept with the eye constantly directed to the instrument, the actual time of signal may be lost, perhaps also again to be lost on the following day through similar accident. By the new instrument, however, the instant the current is sent the needle on its dial is deflected, and simultaneously a bell rings and continues to ring so long as the current is passing. The index-needle, or in other words the needle of the galvanometer, which is the principal feature of the invention, when deflected, presses against a small spiral spring surrounding the stops or ivory pins on the dial plate, and by this contact the galvanometer forms itself into a "relay" and brings a local battery in circuit with the bell, which is contained in the same instrument, so that when the first part of the time-signal is sent the needle is deflected, and at the same moment the bell rings; thus attention to the time is at once arrested. It should be mentioned that the resistance to the line, although low, is intended to be inserted only during the transmission of the time-signal, as by means of what is generally termed a "switch" the instrument is put on and off the circuit at will, and employed only during the time set apart for the transmission of the "Greenwich Time Signal." However feeble the current may be, the galvanometer is so sensitive that a deflection of its needle is absolutely certain, whilst the bell cannot fail to answer to the power of its local battery. We are informed that not only is Messrs. Francis and Co.'s new instrument capable of doing what we have already stated, but it may be made available for communication from different parts of the building, an advantage which is certain to

be recognised and approved by many conducting large business establishments, where the saving of time in conveying messages and giving orders is a matter which is not unfrequently of great importance.

A. P. S. WRITES:—During the late severe frost we had a number of bottles broken in our laboratory by the freezing of their contents, and it is curious to observe what salts tend to prevent such an occurrence. Out of thirty sets of reagents the following were destroyed:—27 ammonium oscalate, 7 calcium sulphate, 8 potassium ferrocyanide, 1 lead acetate. It is remarkable that not one bottle of lime-water was frozen. That calcium sulphate, which only contains $\frac{1}{100}$ th of solid, should freeze, is not astonishing; but the ammonium oscalate bore away the palm with ease, although the amount dissolved was considerable. A single bottle of saturated solution of alum was broken, also one of mercuric chloride. A curious thing happened to one bottle, which shows, I think, that ice does not expand suddenly when it freezes. I unstoppered a bottle of Am_2O that was still liquid, when the contents immediately solidified in my hand, without bursting the bottle. The next day I found the ice had protruded $\frac{3}{4}$ inches from the neck of the bottle, carrying the stopper at its extremity.

THOSE who wish to see women have every fair play in the struggle for existence may be interested to know that at 399, Edgeware Road, Mme. Lina from Geneva is prepared to do good work as a practical watchmaker and jeweller.

A NUMBER of holes of the same description as those which have been observed at Blackheath have been opened in several parts of Paris. These enigmatical holes are several yards wide, long, and deep. Men of science are trying to solve the mystery of their formation.

A VERY satisfactory report was given at the recent annual meeting of the Birmingham Natural History Society, which now has apartments in Mason's College. The number of members is 382.

MR. J. B. JORDAN has issued a little pamphlet giving an account of his glycerine barometer, with plate and tables of correction for temperature. Stanford is the publisher.

UNDER the title of "All about Cardamoms, Botanical Descriptions, Commercial Uses, and Modes of Cultivation," a pamphlet of forty closely-printed pages has recently been issued in Colombo from the office of the *Ceylon Observer*. In this useful little pamphlet nothing new or original is professed to be given, it is simply a compilation of all matter bearing on the subject collected from all available sources, each article being printed in its entirety and its source acknowledged. Thus we find the article on Cardamoms from the latest edition of the *Encyclopædia Britannica*, Flückiger and Hanbury's *Pharmacographia*, Bentley and Trimen's *Medicinal Plants*, and many others. In this arrangement there is of course much repetition of the same matter, but the idea is good as bringing together all that has been published on a given subject which is frequently scattered through many, and often inaccessible publications.

THE works for the Paris Exhibition of Electricity will soon begin. A viaduct will be built for the English electrical railway by Siemens, which will convey visitors from the Place de la Concorde to the Palais de l'Industrie. The internal arrangements will only be made at the end of the Art Exhibition, which will take place from May to July. The French exhibitors of the electric light have come to an agreement in order to combine for the illumination of the nave and other parts. They are trying to obtain from the High Commission an indemnity for their working expenses. It is desirable that the English Government appoint without delay an agent on behalf of the intended English exhibitors, who may be numerous, even in the light department.

ANOTHER slight shock of earthquake was felt at Berne on the night of the 1st inst. Fresh earthquake shocks are reported from Agram, where shocks were observed on January 25 at 1h. 15m. (in the morning) 11h. a.m.; on the night of January 26 at 11h. 28m.; in the morning of January 31 at 3h.; on January 3 at 3h. (in the morning), 1h. 15m., and 4h. 13m. p.m. In the night of January 27-28 shocks were felt at St. Ivan, Zelina (Hungary) at 12h. 52m., 3h. 9m., 4h. 32m. On January 28 two shocks were felt at Gurkfeld (Carinthia) and neighbourhood at 8h. 50m. p.m., direction north-west to south-east. Earthquakes were also noticed on January 25 at Venice, Bologna, and Padua. In the night of January 3-4 shocks were observed in the regions of the Carinthian Alps, in Klagenfurt, at 2h. 22m. 25s., direction east to west, duration 5-6s.; in Trieste at 2h. 24m., direction north-east to south-west, duration about 4s.; at the same time shocks were felt in Laibach, in Gurkfeld, and in Czegled (Hungary).

AN examination has taken place at Brussels of the railway *employés*, in order to test their eyes. More than one-twentieth of them have been found defective, and consequently will be discharged as being unable to fulfil their functions with a sufficient security for travellers.

THE AURORA AND ELECTRIC STORM OF JANUARY 31

WE have received the following further communications on the recent brilliant display of aurora:—

THE beautiful display of aurora on the evening of Thursday was accompanied by the usual earth-current disturbances. They were evident over the whole of the United Kingdom. Telegraphic lines were stopped, railway block-signals were disturbed, and all the usual accompaniments of these curious storms were observed.

The electric storm commenced about 3 p.m., it reached a maximum at 6.40 p.m., and disappeared about 9 p.m. It was renewed about 11 p.m., and disappeared again about 1 a.m. on the next morning. The currents attained an intensity that I have never before observed. At Llanfair in Anglesey they measured 41.4 millivebers. At Haverfordwest 30 millivebers; at Bristol 17.32 millivebers; in the Central Station, London, 11 millivebers; at Edinburgh 8 millivebers. Now as working-currents vary from 5 to 10 millivebers, it is clear that these uninvited wanderers must play sad havoc with the working telegraphs. In some instances they were strong enough to ring the bells used on railways. They are eliminated, where this can be done, by joining two wires in *metallic circuit*, and so excluding the earth. They were characterised by the usual reversals, the direction of the current changing slowly. The changes in direction and variation in strength were always observed on the southern lines first. The line of maximum force commenced south-east to north-west, then passed south to north, and ended south-west to north-east.

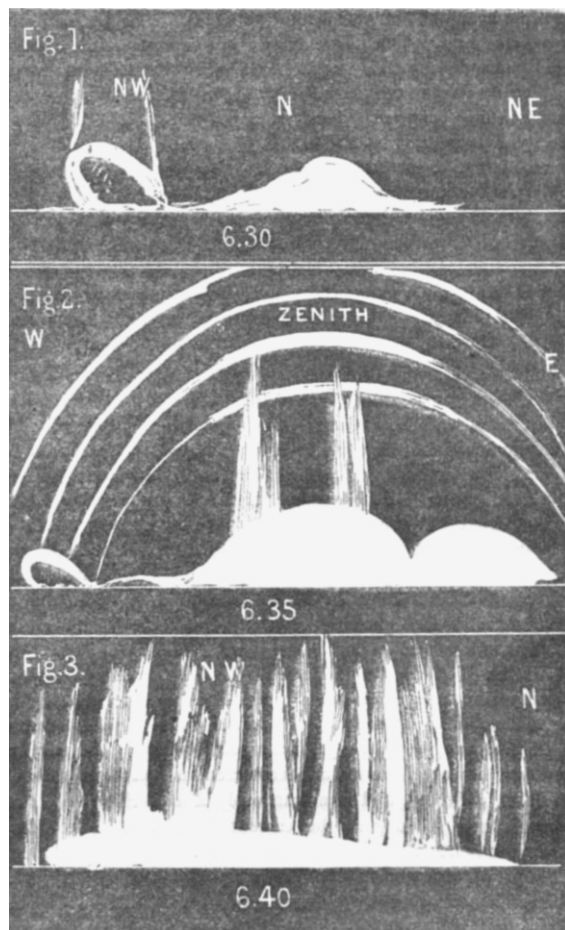
It is unfortunate that on such occasions the whole energies of the technical staff are taken up in maintaining communication, and that no time or means can be found to obtain accurate measurements. The results however, such as they were, fully confirm my view that these storms are due to a violent disturbance of the distribution of electric potential on the earth's surface arising from violent changes in the electrification of the sun. There was a violent disturbance in the sun's envelope on that day, as I learn from Mr. Norman Lockyer, and I am looking with interest to some particulars of it.

February 5

W. H. PREECE

ON yesterday evening, January 31, a most brilliant display of the aurora was seen here. It was by far the finest I have seen,

and others have expressed the same opinion. At 6.25 p.m. I saw a considerable illumination on the northern horizon, and an outlying bright patch on the north-west having somewhat the appearance of the zodiacal light, as shown in the sketch, Fig. 1. This outlying patch was distinctly in motion along the horizon towards the west; streamers from the horizon then shot up, and there appeared several arches of light apparently about the width of an ordinary rainbow, passing from the north-west to north-east points on the horizon; these arches gradually approached the zenith, and the southernmost from the east and west points of the horizon at last passed through it. Some of these arches are shown in Fig. 2, but there were more visible. In a few minutes, about 6.40, the arches faded, and there appeared, rather west of north, a mass of bright green light; then the



streamers from the north lengthened out, as shown in Fig. 3, converging on the Pleiades, as near as I could judge; waves of red light commenced to pass upwards along them, and large sheets of light appeared to pass rapidly over the sky. The streamers gradually died away, leaving flashing lights near the horizon, which in their turn left a slight light over the northern horizon, which gradually faded away. Mr. Percy Smith made the sketches, but owing to the rapid changes their accuracy is only general. Both he and I saw only one line in the spectrum in the usual place.

GEORGE M. SEABROKE

Temple Observatory, Rugby, February 1

THE aurora observed during the evening of January 31 was accompanied by a magnetic perturbation, and although it was on a much smaller scale than that registered on August 12 to 14 last, a brief account of it may possess some slight interest to your readers.

The magnets of all three instruments at Kew, the declination, bifilar, and balance magnetometers, began to be disturbed to a somewhat larger extent than usual about noon on the 31st, the